



Understanding complex climate systems to improve predictions

The march of the seasons in the world, climate swings like a pendulum between summer and winter in the tropics, where the weather is warm year-round, rainy seasons alternate with dry seasons and each has its own distinct pattern of prevailing winds.

But the rhythm of the seasons cannot always be relied upon. But the rhythm of the seasons cannot always be relied upon. But the rhythm of the seasons cannot always be relied upon. But the rhythm of the seasons cannot always be relied upon. But the rhythm of the seasons cannot always be relied upon.

events may result in climatic fluctuations. events may result in climatic fluctuations. events may result in climatic fluctuations. events may result in climatic fluctuations. events may result in climatic fluctuations.

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to the beat of a different drummer, to the beat of a different drummer, to the beat of a different drummer, to the beat of a different drummer, to the beat of a different drummer,

countless species of plants and animals along with hundreds of beings. Over longer time spans, countless species of plants and animals along with hundreds of beings. Over longer time spans, countless species of plants and animals along with hundreds of beings. Over longer time spans, countless species of plants and animals along with hundreds of beings. Over longer time spans, countless species of plants and animals along with hundreds of beings.

sun and the amounts of greenhouse gases. sun and the amounts of greenhouse gases. sun and the amounts of greenhouse gases. sun and the amounts of greenhouse gases. sun and the amounts of greenhouse gases.

caused the climate to swing in and out of ice ages. caused the climate to swing in and out of ice ages. caused the climate to swing in and out of ice ages. caused the climate to swing in and out of ice ages. caused the climate to swing in and out of ice ages.

Climate observations, target observations, technology have provided a capability today to predict signals and to predict longer-term climate signals and to predict longer-term confidence. Climate researchers are now able to simulate confidence. Climate the current climate, including the current climate, including the seasonal of the major rain belts and storm tracks, and of the major rain belts and storm tracks, and of the major rain belts and storm tracks. However, major gaps in understanding However, major gaps in understanding the occasional lapses in the occasional lapses in the occasional lapses in the accordingly.

The sharp rise in demand for NOAA research agenda to improve knowledge control our climate. For advance will mitigate agricultural and economic impacts, as well as a water resource management. The possibilities water resource management. T nearly endless, but extensive research is still needed to fully realize them. NOAA Research addresses these key research:

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Tremendous potential exists for enhanced prediction of our variable improvement can save millions of lives and billions of dollars significant changes in sea level, and potential significant changes working to better characterize the natural and human influences on and global scales to help society cope with potential impacts.

Climatic events have a variety of impacts across regions, sectors, and individuals. Climate variability affects crops, oil prices, reservoir levels, construction and seasons, tourism, insurance costs, snowmelt, and many other costs, etc. NOAA researchers are creating innovative tools, technologies, and services to help society understand and adapt to climate change. NOAA is also working to increase economic gain by providing the knowledge base necessary to

Climate change and variability can also significantly affect human health. Climate change, for example, has increased the frequency and intensity of extreme weather events such as hurricanes, droughts, and floods. El Niño, increased rainfall in the U.S. Southwest fostered vegetation growth which increased the risk of wildfires. These changes have raised concerns about the threat of a hantavirus outbreak. Scientists are working to forecast the climatic conditions under which these threats to human health thrive.

Increasing environmental threats, such as climate change, can increase environmental threats, such as climate change, around the world. Rising numbers of displaced persons and immigration aggravate environmental and political systems. NOAA is building an improved system that would vastly strengthen governments' ability to address security problems.

- " Provide the *in situ* observation and monitoring program (ocean observation term, high-quality record of the climate system, its variability, and changes that are occurring;
- " Conduct field and laboratory experiments to understand induced chemical changes occurring in the global atmosphere, especially the ozone layer;
- " Better characterize and understand the role of the oceans in weather and climate predictions;
- " Obtain the understanding and skills needed to forecast short-term climate fluctuations;
- " Develop the climate system models necessary to understand climate change, reproduce the natural variability of the Earth's climate, and project future climate change;
- " Provide science-based information regarding climate variations to policy-makers;
- " Meet increasing national demands for integrated climate information produced by converting advances in research to practical application; and
- " Understand and characterize the recovery of the climate system over the coming decades.